Solution-Processable Thermally-Activated Delayed-Fluorescence Dendrimer for OLED Application

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The development of emitting materials for OLEDs has started with fluorescence, moved to phosphorescence, and recently reached thermally activated delayed fluorescence (TADF). TADF has the advantage of a high internal quantum efficiency (up to 100%) and low cost. We previously revealed that simple carbazole dendrimers have an outer-layer electron rich potential gradient, i.e., a LUMO at the inner layer, and the HOMO at the outer-layer[1]. Based on this unique electronic structure, we have proved that carbazole dendrimers with appropriate acceptor (triazine[2] or benzophenone[3]) expresses efficient TADF. We now report terminal modified TADF active carbazole dendrimers that are suitable for efficient OLEDs with fully solution-processed organic layers. New TADF active second generation s-triazine core carbazole dendrimers were synthesized (Fig.1 left). OLED devices with the dendrimer and fully solution processed organic layers showed the maximum external quantum efficiency (EQE) of 9.5% (Fig.1 middle, right). It is indicating that the dendrimer is harvesting the electrically-generated triplet excitons through TADF process. Thus, these dendrimers are TADF molecules for efficient OLEDs with fully solution processed organic layers.[4]

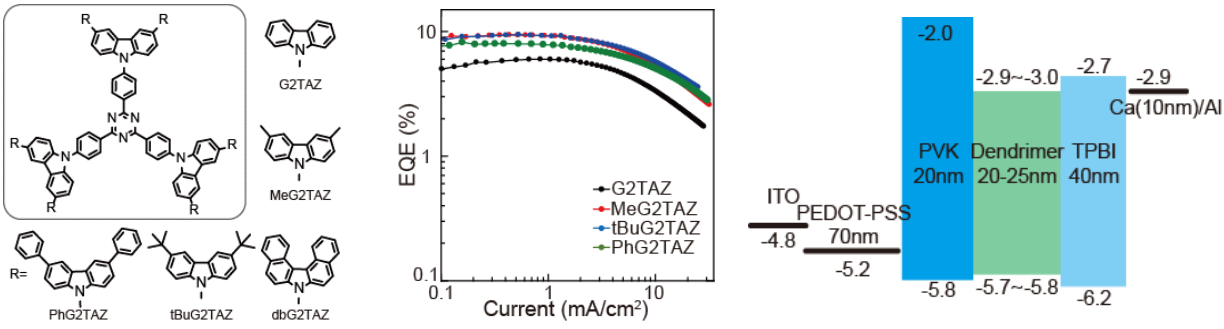

Fig.1 (left) Structure of terminal modified second generation carbazole triazine dendrimers. (middle) External quantum efficiency-current density characteristics for OLEDs with fully solution processed organic layers containing TADF dendrimers as an emitter. (right) Energy diagram of the OLED device.

[1] Albrecht, K.; Yamamoto, K. *J. Am. Chem. Soc.* **2009**, *131*, 2244.
[2] Albrecht, K.; Matsuoka, K.; Fujita, K.; Yamamoto, K. *Angew. Chem. Int. Ed.* **2015**, *54*, 5677 (Highly cited paper, Top 1%).
[3] Matsuoka, K.; Albrecht, K.; Yamamoto, K., Fujita, K. *Sci. Rep.* **2017**, *7*, 41780.
[4] Albrecht, K.; Matsuoka, K.; Yokoyama, D.; Sakai, Y.; Nakayama, A.; Fujita, K.; Yamamoto, K. *Chem. Commun.* **2017**, 53, 2439 (Most downloaded article of 2017).

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